sponsibility with the executive and judiciary is so concentrated as to be worth *something*. But with the legislature it is so diluted as to be of little if any efficacy. In England the omnipotence of Parliament effectually swallows up the other departments. One house exercises the supreme judicial power, and the other exercises the executive power, by controlling the ministry. The framers of our Constitution exhausted their wisdom in endeavors to find some check or restraint for the overwhelming supremacy of the legislative power. But it is to be feared that their failure in this respect will prove as signal, as in the mode of designating the executive.

ART. IV. — *Manual of Geology: treating of the Principles of the Science, with special reference to American Geological History, for the Use of Colleges, Academies, and Schools.* By JAMES D. DANA, M. A., LL. D. Philadelphia: Bliss & Co. 1863. 8vo. pp. 798.

WE suppose that no naturalist in this country has achieved a more distinguished position than the author of this Manual. Perhaps no other has attained equal eminence in two or more very distinct departments of scientific research. Beginning with inorganic nature, Professor Dana's System of Mineralogy — the work of his earlier years — gained at once, and in successive editions has maintained, the foremost rank. Advancing to the organic world, and to forms which, to the general apprehension, seem to combine stone, plant, and animal in one, in his splendid volume on the Coral-Zoöphytes of the South Pacific Exploring Expedition, he proved his talent for the higher order of morphological studies, elucidated the laws of growth, and revised the systematic arrangement of these curious animals and communities. One of his earliest publications was a brief and unpretending paper upon a minute crustacean animal; in later years his elaboration of the Crustacea of the Exploring Expedition, forming an ample volume or pair of volumes of the publications of that expedition, not

only added greatly to our knowledge in this department, but led to some morphological generalizations, which he has recently applied in a very interesting way to the elucidation of one of the scientific questions of the day, namely, that of man's zoölogical position. Turning next to the special department assigned to him in the Pacific Exploring Expedition, Geology, — that science which, uniting the threads of most other natural sciences, would, as it were, weave into one connected and systematic narrative the whole physical and natural history of the earth throughout all past time, — the luminous Report in which Professor Dana published the results of his geological studies during that important exploration appears to contain the germs of most of the characteristic views which are developed, with more or less fulness, in the treatise before us.

The main ideas which underlie, and the spirit which animates, this work, may be briefly indicated by a few detached sentences of the Preface and Introduction. After stating the two reasons which have given to this Manual its American character, namely, the desire to adapt it to the needs of our own students, and a conviction that the geology of this continent exhibits a peculiar simplicity and unity, the author adds: —

"North America stands alone in the ocean, a simple, isolated specimen of a continent (even South America lying to the eastward of its meridians), and the laws of progress have been undisturbed by the conflicting movements of other lands. The author has, therefore, written out American Geology by itself as a continuous history."

"It has been the author's aim to present for study, not a series of rocks with their dead fossils, but the successive phases in the history of the earth, — its continents, seas, climates, life, and the various operations in progress."

"Geology is rapidly taking its place as an introduction to the higher history of man. If the author has sought to exalt a favorite science, it has been with the desire that man — in whom geological history had its consummation, the prophecies of succeeding ages their fulfilment — might better comprehend his own nobility and the true purpose of his existence."

"The earth . . . . . has been brought to its present condition through a series of changes or progressive formations, and from a state as utterly

featureless as a germ. Moreover, like any plant or animal, it has its special systems of interior and exterior structure, and of interior and exterior conditions, movements, and changes; and, although Infinite Mind has guided all events towards the great end, — a world for mind, — the earth has, under this guidance and appointed law, passed through a regular course of history or growth. Having, therefore, as a sphere, its comprehensive system of growth, it is a unit or individuality, ... a WORLD-KINGDOM."

"The systematic arrangement in the earth's features is everywhere as marked as that of any organic species; and this system over the exterior is an expression of the laws of structure beneath. The oceanic depressions or basins, with their ranges of islands, and the continental plains and elevations, are all in orderly plan, are the ultimate results of the whole line of progress of the earth; and, by their very comprehensiveness, as the earth's great feature-marks, they indicate the profoundest and most comprehensive movements in the forming sphere, just as the exterior configuration of an animal indicates its interior history."

So the world is regarded not only as a *cosmos*, but as an *organism*, at least as an organic whole, developed as it were from a germ in the long gestation of the ages. Thus the geographical conceptions of Ritter, familiar to us as expounded by his pupil Guyot, are by a kindred mind felicitously applied, not merely to the present configuration, but to the genesis of our world.

Under this fundamental view, *Physiographic Geology* — the general survey of the earth's external form and systematic features — takes precedence in this Manual, and is concisely presented in forty pages. Next, about twice as many pages are devoted to *Lithological Geology*, treating of the elements of the earth's structure, — first, of the kinds of rocks, and the materials, mineral and fossil, of which they are composed; and then of their condition, or general structure. Then comes *Historical Geology*, forming the main body of the volume, combining an account of the rocks in the order of their formation with the concurrent steps in the progress of life, — from the *Azoic* time or age, in which no records of organic things are discoverable, through the *Palæozoic* — the age first of mollusks, then of fishes, then of coal-plants * — and the *Mesozoic*,

* Since the publication of the work under notice, a distinguished naturalist has

when reptiles predominated, to the *Cænozoic*, to the age of Mammalia, and finally to the *Era of Mind*, the age of man, at length placed upon the completed earth "to have dominion over it," — which earth now subserves its chief and predestined end in nurturing this ultimate creation, this "archon of mammals," for a still more exalted stage, that of spiritual existence.

Finally, *Dynamical Geology*, or an account of the physical agencies or forces which have been active in the production of geological changes, and of the laws and modes of their action, occupies about a hundred and forty interesting pages; and is followed by a few words upon *Cosmogony*. The latter is merely a summary of the views of Guyot, looking to a harmony of the Mosaic cosmogony with modern science, — views which Professor Dana has adopted and maintained elsewhere more in detail, and which, under the circumstances, are naturally enough here reproduced. We regard them with curious interest, but without much sympathy for the anxious feeling which demands such harmonies. We have faith in revelation, and faith in science, in each after its kind; but, as respects cosmogony, we are not called upon to yield an implicit assent to any proposed reconciliation of the two. Yet at the same time we would reverently acknowledge the value of the fact, that the general order of events in creation, as asserted or implied in the Mosaic narrative, on the whole appears to accord, or may be fairly made to accord, with that deduced by science.

An Appendix contains a few special notes, of scientific interest, a Catalogue of American Localities of Fossils, a brief Synopsis of the contents of the work, a list of authorities, and some

proposed the removal of the Carboniferous or great coal period from the Palæozoic to the Mesozoic, from the ancient to the mediæval geological age, drawing the great line of distinction between the Devonian and Carboniferous, instead of between the close of the latter, or the Permian, and the Triassic period or epoch. Had the innovation been earlier proposed, we do not suppose it would have been adopted in the work before us, either on the ground of change wrought by great mountain disturbance, or on palæontological data. So far as we can judge, the clearest and most marked division of all in the life of the globe seems to have been between the Permian and the Triassic, while no such chasm separates the Carboniferous from the Devonian. Reptiles (mostly Batrachian) indeed existed in the Carboniferous, but so did coal-plants in the Devonian, in numerous species, some of them true Gymnosperms even, if we may trust Mr. Dawson.

explanations of scientific nomenclature; and at length a full Index completes the well ordered and compacted volume.

The characteristic and the more or less novel features of this volume, as a text-book of geology, seem to have been developed naturally from the author's systematizing turn of mind, and his way of looking upon nature. With him, facts, although diligently sought out and religiously respected, are valued chiefly as they illustrate ideas and take their place in a system. The fundamental idea is, as we have seen, *the world a pre-ordered, regularly developed system.* "All the world 's a stage" in a wider sense than the poet ever fancied, — on which the inhabitants of age after age in their order have rehearsed the drama of being, but all in final reference to the enactment of that crowning representation in which mankind are the players. That "the earth and all the organic creation exist in reference to man," is indeed a most familiar idea, and one which has been much used, scientifically and popularly, by Agassiz and Guyot; who, even more than Professor Dana, not to say more than rigid natural science may justify, are disposed to regard purposes and ends rather than processes, and formal rather than physical laws, — a fair offset against the materialistic and positive philosophy of the day, but environed with dangers of its own, unless cautiously and temperately handled. Our author, however, who well apprehends the strict requirements of physical research, does not confound the *whereby*, or the *how*, with the *reason why*, although he dwells upon the latter more largely and confidently than is usual in purely scientific works. This, in a text-book for educational purposes, will generally be accepted as a great recommendation. While he regards the world as a development from germ to maturity, from chaos to cosmos, upon a determinate plan to a predestined end, he carefully indicates the physical causes of the successive phenomena, the natural forces which have operated to effect the result. Beginning with the embryo earth with its newly cooled and solidified crust, covered throughout by the waters of a newly condensed ocean, the central point in Professor Dana's view — and, as such, apparently original with him — is, that, from the beginning of the development of the then featureless sphere, the continents

have always been continents, only more or less extensively submerged in earlier times, and the oceans have always been oceans, or more depressed portions. The typical form of a continent, as shown by inspection, is that of a trough or basin, the oceanic borders being raised into mountains, and these borders so directed as to face the widest range of ocean. The height of the border mountains, and the extent of igneous action along them, are in direct proportion to the size of the oceans which they face, the wide Pacific being girt by many and great volcanoes and lofty mountains, while the narrower Atlantic is bounded by lesser heights and few volcanoes. Thus the extent and the position of the oceanic depressions would appear to have somehow determined the general features of the land, the former tending downward as the incipient continents between them tend upward; and so both have been in progress *pari passu* from the beginning of the earth's refrigeration. The profounder features of the earth were sketched in the commencement of geological history; and ever since, the main outlines have only been deepened, and the traits which give the present diversity of features added from time to time, as the work went on. This is quite the opposite of the view according to which oceans and continents have changed places from time to time.

Having from observation apprehended the fundamental plan, our author looks for the instrumental-cause by which the lineaments of Mother Earth have been wrought and fashioned, and varied with her years, from the characterless infantile visage of primordial days to the full expressiveness and the venerable wrinkles of age. The instrumental cause by which these results were determined he finds, primarily, in a literal wrinkling of the earth's rind through contraction in cooling.

"This contraction, going on after a crust was formed over the earth, would necessarily fracture, displace, or wrinkle the crust, as the same cause, contraction, wrinkles a drying apple. The large rind is more than sufficient for the contracted sphere, and the drawing downward of some parts must cause the bulging of others. If any large areas of the crust were sinking more than the rest, this very subsidence would necessarily push up the borders of these areas into angular elevations or folds; and it follows necessarily, that, the larger these areas, the higher

the border elevations. . . . . The oceanic basins are these areas of greatest subsidence; and hence would necessarily flow the law, already established as a matter of fact, that, the larger the ocean, the higher the mountains on its borders, the deeper the fractures and displacements there, and the vaster the outflow of internal heat and lavas. The size, therefore, of the oceans, that is, their extent and depth, is relatively a measure of the force exerted on their sides."

Lest mountain chains should appear much too huge to be accounted as mere wrinkles on the earth's brow, we are reminded that on a section of the North American continent, drawn to a scale of twelve feet long, one ninth of an inch will stand for an altitude of 10,000 feet, one sixteenth of an inch for the White Mountains, and about three tenths of an inch for the Himalayas, — so that, on the whole, it is rather surprising that, on a globe of 25,000 miles in circumference, the tallest summits are barely 30,000 feet above the level of the sea, and less than 100,000 feet above its lowest depths. Future Alpine clubs may rest assured, upon the faith of general dynamic principles, that the summits are never likely to be higher. The earth's stability must, on the whole, increase with its age.

In this view which Professor Dana adopts as the basis of physical geology, — that is, in attributing the plications of the earth's surface, and the elevation of most of its mountains, to a thrust from lateral pressure or tension, and this the inevitable result of the contraction of the crust of a cooling globe, — we find no direct reference to the grand and ingenious, but too empirical system of Elie de Beaumont, "the King of the Mountains," as he may be called. This system, which, successfully applied in the Old World, has crowned a high reputation, assumes that mountain elevations of the same epoch have the same course, so that their direction may be used to determine their relative age. But, besides that no sufficient reason appears why it should be so, at least universally, Professor Dana* shows that in fact the courses of mountain ranges, or lines of uplift, have often in the same region been obviously different in the same period, and, on the other hand, have in this country most largely been the same in different periods, — the whole

* Page 724.

evolution of Eastern North America, indeed, having been effected by a series of uplifts parallel to the primordial outline of our azoic continent, repeated again and again in different ages. So, also, in a subordinate case, the trap ridges south of Lake Superior, although thrown up in the later primordial, have a course parallel to the trap of Nova Scotia and of Virginia and North Carolina, of the Mesozoic, and to the Appalachians, of the close of the Palæozoic age. It is true, however, that the courses of elevation are often different in the same region at different periods; and, under any view, the elevating force may naturally be expected to vary in direction as well as in intensity during the progress of time.

In studying the evolution of continents, Professor Dana turns with a natural preference to North America. This, he assures us, is a normal continent, a model specimen, standing by itself between the oceans, vast enough fully to exemplify the system, and with no contiguous lands to disturb or complicate the action of the organizing forces. Its geology is correspondingly simple, normal, and the best fitted for the discovery and illustration of the grand principles of the science. Europe, on the contrary, is in close contact with Africa and Asia; indeed, a large part of it is only the western border of the Great Orient, answering to North America west of the Rocky Mountains; accordingly, its geological, like its civil history, is marked with complexity, conflict, and confusion; it is full of cross-purposes and incongruities, is broken up into many basins, and broken out into mountains of all ages, even down to the tertiary. It is better adapted for the study of special and subsidiary questions than for the clear exhibition of the general phenomena of the earth's structure, and of the general laws that govern them. These are best learned from the simpler geology of our own continent. The contrast with Europe in this respect, and the principles upon which the greater simplicity of North American geology depends, — embracing the whole system of geological dynamics, — were expounded by our author in his address, as President, to the American Association in 1854, and further developed two years afterward in the American Journal of Science. We can here only refer to these essays, and to a brief section in the Manual on the evolution of the

earth's great outlines and reliefs.* From these the general reader may readily obtain a comprehensive view of the grand scheme. As applied to our own continent, a sketch of its germ, the primal azoic nucleus, outlined upon a map of present North America, exhibits this very continent as then begun; and the argument of the book is to show how it was carried on through the ages, — "each period making some addition to the mainland, as each year gives a layer of wood to the tree," — with many oscillations, but with a sure progress, until the continent was, as we may say, recently completed.

Other things in the volume of general interest, which strike us as characteristic, or as having a certain novelty and originality in the handling, are the admirable temperature chart; the illustration of the system of oceanic movements, with its bearing upon the distribution of animals; the difference between the amount of life in Europe and in America since the palæozoic times, as explained by the distribution of temperature; the great change in the direction of dynamical action in the later age, introducing northern movements of elevation and of subsidence since the tertiary, so determining the glacial and post-glacial periods; the introduction of the term "Age of Mollusks" as characteristic of the Silurian period, instead of Murchison's "Age of Invertebrates," which is nearly as proper; the idea in historical geology, that an age or period has its roots in preceding time, its precursor events, and, as based on the progress of life, its precursor species (fishes beginning before the age of fishes, reptiles prophesied in species that lived in the earlier carboniferous age, mammals occurring before the close of the reptilian age, and perhaps he will have to add man before the human period); the culmination of the class of mammals, or their maximum development, in the post-tertiary age, which they distinctively characterize, and their diminution since, giving way to the "Age of Man," which our author discriminates from the preceding (whether on sufficient grounds is not yet certain); the doctrine of *cephalization*, or the determination of the relative rank of animals in a class by a consideration of the proportion of the parts or the amount of the organism appropriated to the head, or to cephalic functions or uses

* Pages 731 – 740.

(a principle which Professor Dana brought out in the study of Crustacea, and which he is now ingeniously applying to the human question, as giving a structural or zoölogical expression of the exalted intellectual character of man); and, not to enumerate further, the order of the introduction of animals of successive ranks through what he calls *comprehensive* types. Agassiz, who long ago brought out this last idea, and insisted on its application, used the designation *synthetic* types, — a name not free from objection, "as it implies that they correspond to a combination of what was before separate, rather than to one yet undivided," but which in our view there was not sufficient occasion for superseding.

The idea which these terms, whichever be adopted, are intended to express is, that a class or other group made its first appearance, not in its lowest species, but in some higher form, usually partaking of certain characteristics of another and superior group which was afterward to appear. To mention single but striking instances, vertebrates are said to have commenced, "not with the lowest fishes, but with a group above the true level of the fish, in a type which included several characteristics of the higher class of reptiles"; and the feathered reptile or reptilian long-tailed bird — whichever naturalists may finally agree to denominate the *Gryphosaurus* or *Archeopteryx*, found in the stone quarries of Solenhofen — is equally a comprehensive type or synthesis of reptile and bird. These and similar illustrations of "progressive departure from a general to special types" engage the highest interest, and task the conceptions of philosophical naturalists, whether, with Agassiz and Dana, they chiefly regard the plan of the Creator in the gradated connection of beings from the ideal side, or whether, with Darwin, Lyell, and Owen, convinced that "the idea of a forecasting, designing Power is not incompatible with the conception of the constitution of an organized species by the operation of forces and influences which are part of the ordained system of things," they speculate upon "the nature and adjustment of influences forming part of the general system of our planet, acting and reacting under certain conditions so as to issue in such a result," and not only entertain "the conception of the origin of species by a continuously operative

secondary cause or law," but also assign grounds on which they base the probability "that organic species are the result of still operating powers and influences." *

That the most distinguished and philosophical "comparative zoölogist" of the day should thus pronounce upon these questions, — should not only maintain the probability of "a continuously operative secondary creational law," which "works by derivation of one species from a previous species, of a new from an old species," but also that "organisms . . . . . are coming into being, by aggregation of organic atoms, at all times and in all places, under their simplest unicellular condition," and with "the disposition to vary in form and structure according to variation of surrounding conditions," this disposition "being greatest in these first-formed beings; . . . . . [that] from them, or such as them, are and have been derived all other and higher forms of organisms on this planet; . . . . . and [that] thus it is that we now find energizing in fair proportions every grade of organization from Man to the Monad, — each organism, as such, also propagating its own form for a time under such similitude as to be called its kind"; † — all this, we say, will startle many minds, yet will not greatly surprise those who have attentively watched the course of thought in science and even in Professor Owen's former writings. Indeed, he now refers to his celebrated treatises on the Homologies of the Vertebrate Skeleton, and on the Nature of Limbs, as indicating the principal zoölogical grounds for a derivative hypothesis; thus, it would appear, accepting as correct the inference long ago drawn by Professor Bowen,‡ that the doctrines of morphology naturally and logically imply the genetic connection of the beings morphologically related.

It is proper to state that Professor Owen puts forth these views as most probable, indeed, but as purely hypothetical, and guards them by arguments to prove that in such orderly evolution "the broad features of the course may still show the unmistakable impress of Divine volition." Whether we

* The above extracts are selected and brought together from different passages of the Monograph on the Aye-Aye, by Richard Owen, D. C. L., F. R. S. (London 1863), pp. 60–66.

† Owen, Monograph on the Aye-Aye, pp. 62, 63, and 66.

‡ Lowell Lectures, 1849, p. 28.

like his philosophy or not, — and we incline to agree with him that it "may be called fatalistic," — we cannot doubt that these new opinions are held theistically and reverently, and that they may "engender in such minds a spirit of grateful devotion." However delicate the ground upon which the naturalists have presumed to tread, the arena is now fairly open. We cannot debar them if we would, nor ought we if we could. The discussion must needs proceed, and we may fearlessly await the issue. The fortress of natural theology has not become less impregnable through successive changes of its outworks. These may well assume new forms from time to time, according to the attack. None of the threatened positions command the citadel.

We are bound to add, that Professor Owen is disposed to make much of the differences between his hypothesis and that of Mr. Darwin. The differences are manifest, but, we suppose, neither fundamental nor irreconcilable. Both assert a genealogical connection between similar organic forms, and maintain the probability of an ascensive connection between the members of the whole series of forms, from the lowest to the highest. The latter sets out with certain created organisms, or even with certain primary types, whose origination, through causes now in operation, is thought to be inadmissible. The former, as we have seen, conceives of the simplest organisms as themselves coming into existence at all times and in all places under favorable circumstances, — as "now as heretofore in course of creation or formation, with innate capacities of variation and development, by the ordained potentiality of second causes," that is, eliminating surplusage, through second causes. Owen emphatically asserts a belief that all is "a pre-ordained result of the Creator of the arrangements." Darwin implies this. The latter sets forth a *modus operandi*, by which, as he thinks, the diversification of species may be probably explained, and so he exposes his theory fully and fairly to hostile criticism, and to scientific investigation as to whether his assumed causes are real and sufficient. The former, while suggesting the idea of "creation by law," professes total ignorance of what the law is, and how the supposed changes have been brought about under it, and so eludes criti-

cism. One theory honestly offers a body which may be thrust at in broad daylight; the other, in dim twilight, presents a portentous shape, which cannot be struck down, because there is nothing tangible to hit. Yet, if only a cloudy pillar, it is none the less a notable sign-post on the road of advancing belief, but of a belief which far outruns demonstration.

Watching, as we must, with profound interest, all indications of the working of the minds of the leading naturalists of the time, we turn to read what Professor Dana has to say or to intimate upon these high topics. We find it in a summary, under the head of "The Progress of Life." * First, he assures us that there is a system in the progress of life, — an ascent throughout, though not a lineal ascent, from the lowest species to the highest; that, as already mentioned, a type was not usually instituted by the introduction of its lowest species, or developed by the appearance of species just in the order of grade, the earliest types being intermediate or comprehensive types, and the progress of each being an unfolding or exhibition of it in its possible diversities, both inferior and superior, but always the general before the special; that there is a culmination in time for each group, a revelling exuberance in the display of a type after its true level is attained, and at length a decline, sometimes a strongly marked decline, in the character of the species that preceded its final extinction. As to the relation of the history of life to the physical history of the globe, his propositions are: —

"1. That the plan of progress was determined with reference to the last [we suppose the present, regarded as the final] age, with all its diversities of climate, continental surfaces, and oceans, as its era of fullest exhibition."

"2. The progress in climate and other conditions involved a concurrent progress from the inferior living species to the superior."

"3. The progress in climate and in the condition of the atmosphere and waters involved a localization of tribes of time, or chronographically, just as they are now localized by climate over the earth's surface, or geographically..... No species survived through all time, and few through two successive periods. The oldest now existing began in the middle tertiary, and these were only invertebrates. The oldest quadruped dates no farther back than the post-tertiary."

* Pages 592 - 602.

"4. The extermination of species was in general due to catastrophes, while the extinction of tribes or higher groups may have been a consequence of secular changes in the conditions of the climate, atmosphere, or waters."

As in the great systems of theology, so here in geology and natural history, all is regarded from the highest, that is, the Divine point of view, the plan or purpose of the Creator being presumed or inferred; but the operations, in all except the introduction of the successive species, are supposed to be physical and natural. Climates and other conditions are referred to as instruments or operating causes of the localization and duration of species, but not in the way of *preter*natural coadaptation, if we may use this word, as the views of Agassiz would seem to imply. When we come to the question of the origination of the species themselves, Professor Dana emphatically pronounces his opinion that here geology suggests no theory of natural forces; that it is legitimate and right to search out Nature's methods, and to employ her forces in the effort, vain though it prove, to derive thence new living species. But he insists that the study of fossils has brought to light no facts sustaining a theory which derives species from other species, either by a system of evolution or by a system of variations of living individuals. Geology, he declares, bears strongly against both hypotheses. And in a peroration, of which all must admire the spirit, and of which Professor Owen, we presume, from the same point of view, would equally adopt the sentiment and the language, he declares that

"Geology appears to bring us directly before the Creator; and while opening to us the methods through which the forces of nature have accomplished his purpose, — while proving that there has been a plan glorious in its scheme and perfect in system, progressing through unmeasured ages, and looking ever towards Man and a spiritual end, — it leads to no other solution of the great problem of creation, whether of kinds of matter or of species of life, than this: — DEUS FECIT."

Let us remark, in closing, that — notwithstanding the attractiveness of these high themes, and notwithstanding the general predilection evinced in this country for elementary and theoretical geology — this Manual is not a book for popular reading. However clear (and no book was ever clearer), it is

too complete, too massive, and too strictly conscientious and particular for that, — too encyclopedic, systematic, and compacted. It should be received for what it professes to be, — a manual for systematic instruction and reference, a thoroughly elaborated text-book. As such, it is worthy to take its place along with the "System of Mineralogy," upon which the author first established his fame at home and abroad. As far as possible, the Manual of Geology "has been adapted to two classes of students, the literary and the scientific, by printing the details in finer type," by a well-digested synopsis, and by gathering into "general observations," at the close of each period, a summary of the leading facts and the more important deductions; so that, while for the American geological student this work is all-essential, the general inquirer who takes it up in the spirit of a student, and turns to its pages again and again, will be amply rewarded.

A full treatise, like this, was first and most wanted, and the desideratum is now supplied by the most competent hand. Improvements and minor changes will of course be suggested from year to year, — indeed, from month to month. Next to the labor and care of constructing such an edifice is the charge of keeping it in good repair. We cannot expect, and could not wish, to see this work shorter in future editions. Yet, for the majority of classes, and as a text-book for elementary instruction, it is superabundant. We bespeak from the same masterly hand a syllabus, or a strictly elementary Introduction to Geology for classes, on the plan of the present work.